Simulation of multicomponent multiphase flow using lattice Boltzmann method

Abstract :

We present a lattice Boltzmann study of a droplet dynamics on solid surface. For this purpose, a lattice Boltzmann model by Shan and Chen (SC) was used in modeling two-dimensional (2D) multicomponent multiphase (MCMP) of droplet dynamics. The miscible/immiscible region is determined for couples of initial densities and cohesion strengths through droplet tests. The chosen densities were then test with Laplace and good correlation was achieved. Then, the dynamic behavior of the droplet is investigated through the study of the surface adhesion strength between fluid-solid surfaces. The results were compared with the analytical solutions and good agreements were achieved. Gravitational effect was successfully included for simulating droplet dynamics on solid surface by incorporating Bond number. The simulation was extended by studying the displacement of droplets on solid surface due to variations of contact angle, plate inclination and Bond number. The results show the capability of Shan-Chen lattice Boltzmann model to simulate the problems.